

Amendments

Please amend this application with respect to the matters set forth below concerning the claims:

In the Claims:

Please (a) rewrite Claims 20~22, 25~27 and 29~41; (b) cancel Claims 1~19 without prejudice to or disclaimer of the subject matter thereof; and (c) add new Claims 39~41.

The requested amendments to Claims 20~22, 25~27 and 29~41 are shown below in the Listing of Claims (contained on pages 3~12 of this paper) in a marked-up version of those claims, as required by 37 CFR §1.121(c). Deletions are shown by strike-through, and additions are shown by underlining. Also shown on pages 3~12 are new Claims 39~41, and a complete listing of all other claims indicating the status thereof.

Listing of Claims

[including (i) amendments to Claims 20~22, 25~27 and 29~38; (ii) new Claims 39~41; and (iii) status of all claims;
(Claims 20~22, 25~27 and 29~41 are now active)]

- 1 ~ 19. (cancelled).
20. (currently amended) An apparatus for analyzing a multi-component gas mixture, comprising:

(a) an array of four or more chemo/electro-active materials, each chemo/electro-active material exhibiting a different electrical response characteristic, upon exposure at a selected temperature to the gas mixture, than each of the other chemo/electro-active materials;

wherein the chemo/electro-active materials are selected from the group consisting of (i) the chemo/electro-active materials that comprise M^1O_x ; (ii) the chemo/electro-active materials that comprise $M^1_aM^2_bO_x$; and (iii) the chemo/electro-active materials that comprise $M^1_aM^2_bM^3_eO_x$;

wherein M^1 is selected from the group consisting of Al, Ce, Cr, Cu, Fe, Ga, Mn, Nb, Nd, Ni, Pr, Sb, Sn, Ta, Ti, W and Zn;

wherein M^2 and M^3 are each independently selected from the group consisting of Ga, La, Mn, Ni, Sn, Sr, Ti, W, Y, Zn;

wherein M^1 and M^2 are each different in $M^1_aM^2_bO_x$ and M^1 , M^2 and M^3 are each different in $M^1_aM^2_bM^3_eO_x$;

wherein a, b and c are each independently about 0.0005 to about 1; and

wherein x is a number sufficient so that the oxygen present balances the charges of the other elements in the chemo/electro-active material; and

(b) means for determining an individual electrical response of each chemo/electro-active material upon exposure of the array to the gas mixture;

wherein at least four chemo/electro-active materials comprise a group of four materials selected from one of the following groups

the group of chemo/electro-active materials comprising, respectively, $\text{Ga}_a\text{Ti}_b\text{Zn}_c\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, and SnO_2

the group of chemo/electro-active materials comprising, respectively, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, and ZnO

the group of chemo/electro-active materials comprising, respectively, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and ZnO ; and

the group of chemo/electro-active materials comprising, respectively, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, $\text{Ti}_a\text{Zn}_b\text{O}_x$, and ZnO ;

wherein a, b, c and x are as set forth above; and

wherein the apparatus determines the concentration within the multi-component gas mixture of ammonia and one or more nitrogen oxides, and determines the presence or concentration within the mixture of a hydrocarbon.

wherein at least four of the chemo/electro-active materials in the array comprise one of the following groups of four materials:

the group of chemo/electro-active materials comprising, respectively,
 $Ga_aTi_bZn_cO_x$, $Nb_aTi_bO_x$, $Ni_aZn_bO_x$, and SnO_2

the group of chemo/electro-active materials comprising, respectively,
 $Nb_aTi_bO_x$, $Ni_aZn_bO_x$, $Sb_aSn_bO_x$, and ZnO

the group of chemo/electro-active materials comprising, respectively,
 $Ni_aZn_bO_x$, $Sb_aSn_bO_x$, $Ta_aTi_bO_x$, and ZnO ; and

the group of chemo/electro-active materials comprising, respectively,
 $Sb_aSn_bO_x$, $Ta_aTi_bO_x$, $Ti_aZn_bO_x$, and ZnO ;

wherein a, b and c are each independently about 0.0005 to
about 1; and

wherein x is a number sufficient so that the oxygen present
balances the charges of the other elements in the chemo/electro-active
material;

(b) means for determining an individual electrical response of each
chemo/electro-active material upon exposure of the array to the gas mixture;
and

(c) means for obtaining, from no information about the gas mixture
other than the individual electrical response of the chemo/electro-active

materials, a determination related to the presence or concentration of a component in the gas mixture.

21. (currently amended) An apparatus for analyzing a multi-component gas mixture, comprising:

(a) an array of six or more chemo/electro-active materials, each chemo/electro-active material exhibiting a different electrical response characteristic, upon exposure at a selected temperature to the gas mixture, than each of the other chemo/electro-active materials;

wherein the chemo/electro-active materials are selected from the group consisting of (i) the chemo/electro-active materials that comprise M^1O_x , (ii) the chemo/electro-active materials that comprise $M^1_aM^2_bO_x$, and (iii) the chemo/electro-active materials that comprise $M^1_aM^2_bM^3_cO_x$;

wherein M^1 is selected from the group consisting of Al, Ce, Cr, Cu, Fe, Ga, Mn, Nb, Nd, Ni, Pr, Sb, Sn, Ta, Ti, W and Zn;

wherein M^2 and M^3 are each independently selected from the group consisting of Ga, La, Mn, Ni, Sn, Sr, Ti, W, Y, Zn;

wherein M^1 and M^2 are each different in $M^1_aM^2_bO_x$, and M^1 , M^2 and M^3 are each different in $M^1_aM^2_bM^3_cO_x$;

wherein a , b and c are each independently about 0.0005 to about 1; and

wherein x is a number sufficient so that the oxygen present balances the charges of the other elements in the chemo/electro-active material; and

_____(b) means for determining an individual electrical response of each chemo/electro-active material upon exposure of the array to the gas mixture; wherein at least six chemo/electro-active materials comprise a group of four materials selected from one of the following groups

_____ the group of chemo/electro-active materials comprising, respectively, $\text{Cr}_a\text{Mn}_b\text{O}_x$, $\text{Mn}_a\text{Ti}_b\text{O}_x$, $\text{Nd}_a\text{Sr}_b\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{Zn}_e\text{O}_x$, Pr_6O_{11} , and $\text{Ti}_a\text{Zn}_b\text{O}_x$

_____ the group of chemo/electro-active materials comprising, respectively, $\text{Al}_a\text{Ni}_b\text{O}_x$, $\text{Cr}_a\text{Ti}_b\text{O}_x$, $\text{Fe}_a\text{La}_b\text{O}_x$, $\text{Fe}_a\text{Ni}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, and $\text{Sb}_a\text{Sn}_b\text{O}_x$

_____ the group of chemo/electro-active materials comprising, respectively, $\text{Al}_a\text{Ni}_b\text{O}_x$, $\text{Cr}_a\text{Ti}_b\text{O}_x$, $\text{Mn}_a\text{Ti}_b\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{Zn}_e\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$

_____ the group of chemo/electro-active materials comprising, respectively, $\text{Ga}_a\text{Ti}_b\text{Zn}_e\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$

_____ the group of chemo/electro-active materials comprising, respectively, $\text{Ga}_a\text{Ti}_b\text{Zn}_e\text{O}_x$, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, SnO_2 , $\text{Ta}_a\text{Ti}_b\text{O}_x$, and $\text{Ti}_a\text{Zn}_b\text{O}_x$

_____ the group of chemo/electro-active materials comprising, respectively, $\text{Nb}_a\text{Ti}_b\text{O}_x$, $\text{Ni}_a\text{Zn}_b\text{O}_x$, $\text{Sb}_a\text{Sn}_b\text{O}_x$, $\text{Ta}_a\text{Ti}_b\text{O}_x$, $\text{Ti}_a\text{Zn}_b\text{O}_x$, and ZnO

_____ the group of chemo/electro-active materials comprising, respectively, $\text{Cr}_a\text{Mn}_b\text{O}_x$, $\text{Cr}_a\text{Ti}_b\text{O}_x$, $\text{Cr}_a\text{Y}_b\text{O}_x$, $\text{Cu}_a\text{Ga}_b\text{O}_x$, $\text{Cu}_a\text{La}_b\text{O}_x$, and $\text{Fe}_a\text{La}_b\text{O}_x$

_____ the group of chemo/electro-active materials comprising, respectively, $\text{Al}_a\text{Ni}_b\text{O}_x$, $\text{Cr}_a\text{Mn}_b\text{O}_x$, CuO , $\text{Nd}_a\text{Sr}_b\text{O}_x$, Pr_6O_{11} , and WO_3

the group of chemo/electro-active materials comprising, respectively,
Cr_aY_bO_x, Cu_aGa_bO_x, Cu_aLa_bO_x, Fe_aTi_bO_x, Ga_aTi_bZn_cO_x, and Nb_aW_bO_x; and

the group of chemo/electro-active materials comprising, respectively,
Cr_aMn_bO_x, Mn_aTi_bO_x, Nd_aSr_bO_x, Nb_aTi_bZn_cO_x, Pr_aO_{4+x}, and Ti_aZn_bO_x;

wherein a, b, c and x are as set forth above; and

wherein the apparatus determines the concentration within the multi-component gas mixture of ammonia and one or more nitrogen oxides, and determines the presence or concentration within the mixture of a hydrocarbon.

wherein at least six of the chemo/electro-active materials in the array comprise one of the following groups of six materials:

the group of chemo/electro-active materials comprising, respectively,
Al_aNi_bO_x, Cr_aTi_bO_x, Mn_aTi_bO_x, Nb_aTi_bZn_cO_x, Ta_aTi_bO_x, and Ti_aZn_bO_x

the group of chemo/electro-active materials comprising, respectively,
Ga_aTi_bZn_cO_x, Nb_aTi_bO_x, Ni_aZn_bO_x, Sb_aSn_bO_x, Ta_aTi_bO_x, and Ti_aZn_bO_x

the group of chemo/electro-active materials comprising, respectively,
Ga_aTi_bZn_cO_x, Nb_aTi_bO_x, Ni_aZn_bO_x, SnO₂, Ta_aTi_bO_x, and Ti_aZn_bO_x

the group of chemo/electro-active materials comprising, respectively,
Nb_aTi_bO_x, Ni_aZn_bO_x, Sb_aSn_bO_x, Ta_aTi_bO_x, Ti_aZn_bO_x, and ZnO;

wherein a, b and c are each independently about 0.0005 to about 1; and

wherein x is a number sufficient so that the oxygen present balances the charges of the other elements in the chemo/electro-active material;

(b) means for determining an individual electrical response of each chemo/electro-active material upon exposure of the array to the gas mixture; and

(c) means for obtaining, from no information about the gas mixture other than the individual electrical response of the chemo/electro-active materials, a determination related to the presence or concentration of a component in the gas mixture.

22. (currently amended) An apparatus according to Claim 1, 4, 7, 10, 13, 16, 19, 20 and or 21 wherein a chemo/electro-active material further comprises a frit additive.

23. (cancelled).

24. (cancelled).

25. (currently amended) An apparatus according to Claim 420 or 21 that determines the presence or concentration of a nitrogen oxide and a hydrocarbon in the multi-component gas mixture.

26. (currently amended) An apparatus according to Claim ~~4~~²⁰ or 21 wherein the component gases in the gas mixture are not separated.

27. (currently amended) An apparatus according to Claim ~~4~~²⁰ or 21 wherein the electrical responses of the chemo/electro-active materials are determined upon exposure to only the multi-component gas mixture.

28. (cancelled).

29. (currently amended) An apparatus according to Claim ~~4~~²⁰ or 21 wherein the multi-component gas mixture is emitted by a process, or is a product of a chemical reaction that is transmitted to a device, and wherein the apparatus further comprises means for utilizing the electrical responses for controlling the process or operation of the device.

30. (currently amended) A vehicle for transportation comprising an apparatus according to Claim ~~4~~²⁰ or 21.

31. (currently amended) Equipment for construction, maintenance or industrial operations comprising an apparatus according to Claim ~~4~~²⁰ or 21.

| 32. (currently amended) An apparatus according to Claim ~~4~~20 or 21
| further comprising heating means for separately heating each chemo/electro-
| active material.

| 33. (currently amended) An apparatus according to Claim ~~4~~20 or 21
| wherein each chemo/electro-active material is heated to the same temperature.

| 34. (currently amended) An apparatus according to Claim ~~4~~20 or 21
| wherein one or more chemo/electro-active materials is heated to a different
| temperature than the other chemo/electro-active materials.

| 35. (currently amended) An apparatus according to Claim ~~4~~20 or 21
| wherein the chemo/electro-active materials are on a substrate made from a
| material selected from the group consisting of silicon, silicon carbide, silicon
| nitride, and alumina with a resistive dopant.

| 36. (currently amended) An apparatus according to Claim ~~4~~20 or 21
| wherein the gas mixture comprises an organo-phosphorus gas.

| 37. (currently amended) An apparatus according to Claim ~~4~~20 or 21
| which may be held in the human hand.

| 38. (currently amended) An apparatus according to Claim ~~4~~20 or 21
| which is located in the ventilation system of a building or car.

39. (new) An apparatus according to Claim 20 or 21 that determines the presence or concentration of a nitrogen oxide in the multi-component gas mixture.

40. (new) An apparatus according to Claim 20 or 21 that determines the presence or concentration of a hydrocarbon in the multi-component gas mixture.

41. (new) An apparatus according to Claim 20 or 21 that determines the presence or concentration of ammonia in the multi-component gas mixture.